The philosopher for science

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Karl Popper's ideas have been the touchstone for judging science during much of this century. Here, in acknowledgement of his 90th birthday on 28 July, is a celebration of the man and his works.

SCIENTISTS are a very heterogeneous group of people, as befits a profession that values originality above all. Thus it comes about that only a minority of working scientists question what the nature of science is, or try to explore the demarcation between science and other human endeavours. But among this set of scientists, the name of one student of the philosophy of science brings out the deepest feelings of appreciation and, indeed, gratitude: Karl Popper. His seminal work of well over half a century ago (*Die Logik der Forschung*) is still the basis of how we think about our subject, is still the touchstone of whether one's ideas are scientifically meaningful, or just a jumble of ingenious and perhaps satisfying thoughts.

Popper's teaching in this and in later works on related themes stresses that science is a creative subject. The new ideas, the working hypotheses, the novel experimental arrangements, these are all the result of intellectual jumps and of original thinking, and not of logical deduction or inference. Thus the generation of science cannot be mechanized. There is no possibility of defining a 'scientific method', a prescription that anybody can follow and 'make science'. Scientists have to be people of flesh and blood, of passion and drive, of daring and of courage. (It is unfortunate that in some places the absurd image of the cold, passionless scientist is still propagated.) Directly or indirectly, this point of Popper's has affected our value judgements of scientists and their work. Thus in all those many cases where judging panels have given high marks to originality, Popper's influence shines through.

His basic idea is of theories having to be vulnerable to empirical disproof, with the more rigid and therefore more at-risk theory to be viewed as preferable to the more flexible (or more flabby). This view has profoundly influenced me and many others. The whole relation between experiment and observation on the one hand, and theoretical constructions on the other, is generally seen nowadays in the light of Popper's analysis. The notion of the crucial experiment to disprove a theory antedates Popper, but the appreciation that this is the principal function of experiment and observation we owe to him.

Here again Popper pointed out many years ago what is still not understood by large sections of the population: the true relationship between science and technology. It is unfortunately widely thought that science is primary and technology derivative. In fact, advances in science frequently arise from a novel and more searching experimental method which has become available through technological progress which thus generates new science. As Popper put it so appealingly: "We advance like a person walking through a swamp, first painfully pulling up one leg and advancing it, and then the other. One leg is labelled 'technology' and the other 'science'." It may be that this vital teaching of his has been implicitly understood by the scientific community since the end of the Second World War, when advances in electronics and the ability to use space platforms provided previously unimagined experimental opportunities. It was Popper who made this dependence explicit and clear.

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Karl Popper — an influence shining through.

But perhaps it is his stress on problem-solving as the central activity of humans (indeed, all living organisms can be said to be engaged in problem-solving), which describes so particularly appositely what is done in science. Science is driven forward by unexpected and surprising results emerging from new experiments or by the appearance of contradictions between theories previously thought compatible. Solving such problems as they arise is of the essence of our work. Thus science is not something strange and odd but the most human of pursuits. Hoyle, in his novel *The Black Cloud* puts this so well when a non-scientist says of scientists: "I cannot understand what makes them tick. They are always wrong and they always go on." This very popperian sentiment inspires us all through our trials and tribulations. Popper has made it clear that we should be proud so to be described.

There is, however, a consequence of Popper's analysis that in my opinion has not been taken to heart sufficiently by our community. Criticism and testing are of the essence of our work. This means that science is a fundamentally social activity, which implies that it depends on good communication. In the practice of science we are aware of this, and that is why it is right for our journals to insist on clarity and intelligibility, and why meeting our colleagues at conferences is such an integral part of being a working scientist. But we have hardly begun to take note of this fact in the teaching of science. The priority given to conveying as much material as possible in a limited amount of time means that the teaching of communication skills generally takes a back seat (and often not even that) in undergraduate and postgraduate courses. The consequences of this neglect of an important implication of Popper's teaching are sad: most young (and not so young) scientists find it difficult to talk about their work to the general public and to the media, their lecturing is not always of the best, and even their technical presentations can be hard to follow. So often, when postgraduates write up their PhD theses, these are the first coherent pieces of writing they have done in six or more years. This is hard on them, on their supervisors, and on their examiners. Very gradually the need to teach communication skills is being understood, but it is being acted on only in a very limited way.

This is a brief outline of how one scientist sees Popper's influence today. It leaves out much that is very relevant to our time, such as his inveighing against utopianism in science as much as in politics, his vigour in denouncing illogical and misleading ideas held on authority rather than on evidence, and so on. May we enjoy many more of his characteristic and instructive contributions! □

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